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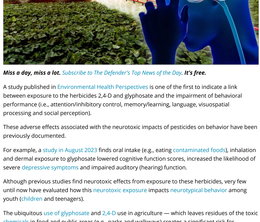
Common Herbicides May Impair Brain Function and Behavior in Children

A study in Environmental Health Perspectives adolescents with higher urine concentrations of the herbicides glyphosate and 2,4,-D scored worse on tests of attention, memory, language and social perception.

By Beyond Pesticides



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A study published in Environmental Health Perspectives is one of the first to indicate a link between exposure to the herbicides 2,4-D and glyphosate and the impairment of behavioral performance (i.e., attention/inhibitory control, memory/learning, language, visuospatial processing and social perception).

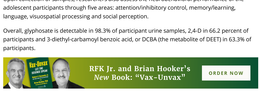
These adverse effects associated with the neurotoxic impacts of pesticides on behavior have been previously documented.

For example, a study in August 2023 finds oral intake (e.g., eating contaminated foods), inhalation and dermal exposure to glyphosate lowered cognitive function scores, increased the likelihood of severe depressive symptoms and impaired auditory (hearing) function.

Although previous studies find neurotoxic effects from exposure to these herbicides, very few until now have evaluated how this neurotoxic exposure impacts neurotypical behavior among youth (children and teenagers).

The ubiquitous use of glyphosate and 2,4-D use in agriculture — which leaves residues of the toxic chemicals in food and public areas (e.g., parks and walkways) creates a significant risk for exposure.

Glyphosate is already implicated in or proven to lead to the development of numerous health anomalies, including cancer, while 2,4-D also has a range of potential hazards, including cancer.



Therefore, studies like this help local and government officials make holistic decisions regarding the use of pesticides that adversely affect human health, especially among adolescents.

The principal investigator José Ricardo Suarez-Lopez, M.D., Ph.D., associate professor at the Herbert Wertheim School of Public Health and Human Longevity Science at the University of California, San Diego, expresses the importance of studying these pesticides for other effects like hormone disruption, mental health, inflammation and additional health systems, and says:

> "Our study will allow us to evaluate the toxicity potential of these and other chemicals assessed from childhood through adulthood."

The neurological system, including the brain, spinal cord, and a vast network of nerves and neurons, is responsible for many bodily functions — from behavior to movement.

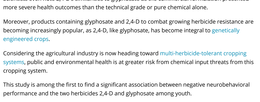
However, pesticides play various roles in causing or exacerbating adverse health outcomes, including neurotoxic effects and chemical damage to the brain.

Numerous pesticides impair neurological function, especially for chronically exposed individuals (e.g., farmworkers) or during critical windows of vulnerability and development (e.g., childhood, pregnancy).

The study evaluates 519 adolescent individuals between the ages of 11 and 17, living in Ecuadorian agricultural communities for the concentration of glyphosate, two N, N-diethyl-meta-toluamide (DEET), 2,4-D and their metabolites (breakdown products) in urine samples.

Upon collection of samples, researchers also assess the neurobehavioral performance of the adolescent participants through five areas: attention/inhibitory control, memory/learning, language, visuospatial processing and social perception.

Overall, glyphosate is detectable in 98.3% of participant urine samples, 2,4-D in 66.2 percent of participants and 3-diethyl-carbamoyl benzoic acid, or DCBA (the metabolite of DEET) in 63.3% of participants.



Although DEET lacks an association with neurobehavioral performance in this study, 2,4-D and glyphosate are negatively associated with neurobehavioral performance.

2,4-D has the highest association with negative neurobehavioral performance for all five areas, with the most significant impacts on attention/inhibition control, language and memory/learning, respectively.

On the other hand, glyphosate only has a significant negative association with social perception. Unlike previous studies, these chemicals do not impact neurobehavioral differences among gender and adrenal hormone function.

Glyphosate is the most commonly used active ingredient worldwide, appearing in many herbicide formulations and readily contaminates soil, water, food and other resources.

Decades of extensive glyphosate herbicide use (e.g., Roundup) have put human, animal, and environmental health at risk. Four out of five U.S. individuals over six years of age have detectable levels of glyphosate in their bodies.

Exposure to glyphosate has implications for the development of various health issues, like cancer, Parkinson's disease, developmental and birth disorders and autism.

Although the U.S. Environmental Protection Agency (EPA) classifies glyphosate herbicides as "not likely to be carcinogenic to humans," stark evidence demonstrates links to various cancers, including non-Hodgkin lymphoma.

EPA's classification perpetuates adverse impacts, especially among vulnerable individuals, like pregnant women, infants, children and the elderly. Like glyphosate, 2,4-D is ubiquitous in the environment from decades of extensive use in agricultural and residential areas.

Current research describes a range of serious hazards from 2,4-D exposure, including the International Agency for Research on Cancer finding that the chemical is a possible human carcinogen (e.g., soft tissue sarcoma and non-Hodgkin lymphoma).

Moreover, exposure to 2,4-D can cause neurotoxic health issues like the development of amyotrophic lateral sclerosis, or ALS and loss of smell, as well as kidney/liver damage and endocrine disruption.

The EPA finds babies born near areas of high 2,4-D use, such as farming communities, have higher rates of birth abnormalities, respiratory and cardiovascular issues and developmental defects.

Although glyphosate replaced much 2,4-D herbicide use during the late 1990s and early 2000s, increasing glyphosate resistance is shifting the market back to heavy 2,4-D use.

However, 2,4-D has striking similarities to glyphosate with growing weed resistance to the chemical and its contribution to the growth of antibiotic resistance in human pathogenic bacteria.

Scientists even note 2,4-D's similarities to glyphosate as the commercial formulation presented more severe health outcomes than the technical grade or pure chemical alone.

Moreover, products containing glyphosate and 2,4-D to combat growing herbicide resistance are becoming increasingly popular, as 2,4-D, like glyphosate, has become integral to genetically engineered crops.

Considering the agricultural industry is now heading toward multi-herbicide-tolerant cropping systems, public and environmental health is at greater risk from chemical input threats from this cropping system.

This study is among the first to find a significant association between negative neurobehavioral performance and the two herbicides 2,4-D and glyphosate among youth.

This research also highlights an increased rate of toxic body burden among adolescents, especially as prior studies note adolescents have higher bodily concentrations of glyphosate than adults, a significant concern for the onset of chronic disease.

Moreover, studies like this are essential because 2,4-D and glyphosate are often formulated together in the market herbicide products.

This study highlights that combined concentrations of 2,4-D and glyphosate are associated with worsened neurobehavioral performance among all five areas (i.e., attention/inhibitory control, memory/learning, language, visuospatial processing and social perception).

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However, the researchers urge further assessments of herbicide mixtures' joint (synergistic) effects among various pediatric and adult populations.

There is a lack of complete understanding of the etiology of pesticide-induced diseases, including predictable lag time between chemical exposure, health impacts and epidemiological data.

Pesticides themselves can possess the ability to disrupt neurological function.

Pesticides' effect on the brain is mainly of concern for chronically exposed individuals or during critical windows of vulnerability and development.

Therefore, studies related to pesticides and neurological disorders can help scientists understand the underlying mechanisms that cause neurodegenerative diseases.

Although occupational and environmental factors, like pesticide exposure, adversely affect human health, regulatory reviews are plagued by numerous limitations in defining real-world poisoning, as captured by epidemiologic studies in Beyond Pesticides' Pesticide-Induced Diseases Database (PIDD) and Daily News Blog.

Pesticides' adverse health effects, exposure and aggregate or cumulative risk showcase a need for a precautionary approach to regulating pesticides, as more precise research is conducted on occupational and residential pesticide exposure — allowing more complete determinations.

Existing information, including this study, supports the clear need for a strategic shift away from pesticide dependency.

For more information on the effects of pesticide exposure on neurological health, see Beyond Pesticides' PIDD pages on brain and nervous system disorders and other impacts on cognitive function.

Organic agriculture represents a safer, healthier approach to crop production that does not necessitate pesticide use.

Beyond Pesticides encourages farmers to embrace regenerative, organic practices, consumers to purchase organic and gardeners and municipalities to adopt organic land management practices.

A complement to buying organic is contacting various organic farming organizations to learn more about what you can do.

Originally published by Beyond Pesticides.

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Beyond Pesticides

Beyond Pesticides is a nonprofit organization headquartered in Washington, D.C., which works with allies in protecting public health and the environment to lead the transition to a world free of toxic pesticides.

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BCHristine
11 days ago
No surprise here. The health consequences will only continue to get worse … our environment is saturated with toxins like these and so many more we're probably not even aware of yet. It's a losing game.

The only thing you can do at this point is be aware, do what you can to be healthy, and pray.

1 Reply Share

Lauren Ayers
12 days ago edited
The good news is these test results are impossible to ignore. Anyone responsible for children's wellbeing would be complicit in child abuse if they let the status quo continue.

We need to set a deadline for correcting the problems, or parents would have cause for lawsuits against the in loco parentis institutions that provide meals for children. In fact, any taxpayer would have a legal basis to sue anyone harming children by giving them empty calories and/or food containing toxins.

Everyone blathers on about our children being the future. Now they need to step up. Public schools corrected past mistakes. I can remember when campus staff rooms wafted cigarette smoke into the halls, and high schools usually had a certain area where smoking by underage students was tolerated.

Also, up until 2006, California schools fed students trans fats in numerous entrees, now it's banned. Clearly, good science helps us finally overcame neglect, and the same can happen with school cafeterias serving conventionally raised food full of glyphosate and 2,4-D.

How to fund such upgrades may appear to be the hardest part – until we remember that an ounce of prevention is always cheaper than a pound of cure.

Seeing a problem clearly is like looking at a nearly completed puzzle with some missing pieces: it's easier to find

see more

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Paul Vonhamm
11 days ago edited
The suggestion of further study would be laughable if it weren't so hopelessly redundant. Studies relating Glyphosate and PFOA surfactants to auto-immune disorders and neurological damages have been ongoing for decades. A search for validated information on synergy between Glyphosate and PFOA surfactants will yield multitudes of scrubbed pages and reference to articles which are no longer available. Why is that?

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Children's Health Defense® is a 501(c)(3) non-profit organization. Our mission is to end childhood health epidemics by working aggressively to remove dangerous exposures, hold those responsible accountable and establish safeguards to prevent future harm. We fight corruption, stop surveillance and censorship that put profits before people as well as advocate for worldwide rights to health freedom and bodily autonomy.

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